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CENTRAL INTELLIGENCE AGENCY

INFORMATION REPORT

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THIS IS UNEVALUATED INFORMATION

1. Purification of germanium and the making of germanium monocrystals for East German transistor development is done at VEB Werk fuer Bauelemente der Nachrichtentechnik "Carl von Ossietzky" (formerly Dralowid), in Teltow, VEB Werk fuer Fernmeldewesen (formerly OSW), in Berlin-Oberschoeneweide, and in the Academy Institute for Research on the Physics of Solids in Berlin-Buch. The methods used in these three places are: 25X1

   a. The Bridgeman method.

   b. The zone melting method.

   c. The Czrochalsky method.

2. The Dralowid plant obtained deliveries of 99.99% pure germanium As of early November 1954, the enterprise had a supply of about one kilogram of germanium of the purity mentioned. This germanium of "Merck purity", as it is referred to in Germany, is processed in the following way according to the Bridgeman method. It is vacuum-melted in a long, tube-shaped quartz crucible. The crucible is connected to a drawing mechanism regulated by a clock, which draws the crucible out of the melting furnace at the slow speed of about 1 millimeter per minute. Through this process, the germanium solidifies in such a way that its upper parts gradually become solid, while the lower parts still exposed to the heat of the oven remain molten until they are also drawn out. Inasmuch as impurities have a tendency to assemble in the molten part and to leave the parts which are in crystalization, the result of this operation is that the upper parts of the germanium will contain fewer impurities than the lower parts, where most of the impurities are assembled. It has been found, for instance, that the ratio of antimony impurities within the crystalized germanium to those in the molten germanium is about 1 to 50. After the process is finished, the solidified germanium is a monocrystal. The next step is to decide which part of this monocrystal is suited for transistor purposes. For this purpose, an electrode is placed upon one 25X1

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longitudinal side of the monocrystal, whereas its other side is scanned with a point-contact and the inverse voltage is thus measured. At the point where the inverse voltage reaches about 20V, the monocrystal is cut into two halves. The upper half is considered sufficiently pure for transistor purposes. The lower half containing the impurities is again subjected to the same procedure. If the lower part contains too many impurities, it is first treated chemically. The germanium is transformed into germanium dioxide (GeO_2) or into germanium tetrachloride ($GeCl_4$). Germanium dioxide is then reduced to germanium with the aid of hydrogen. The germanium tetrachloride is first purified by fractional distillation and then decomposed hydrolytically, with germanium dioxide resulting. The latter substance is then reduced in the described above. The Dralowid plant in applying this method has succeeded in making germanium monocrystals with a maximum purity of 40 ohm centimeter.

3. The method described above is the only one which has been actually applied in the Dralowid plant. However, as of early November 1954 this plant was constructing an apparatus for the application of the "zone meltingprocedure" (Zonenschmelzverfahren) and expected to reach purities up to 70 ohm centimeter with its aid. This procedure is applied to germanium monocrystals produced by the Bridgeman method. The mono crystal with attachments on its upper and lower ends is brought into a cylindrically-shaped melting furnace (Ringofen). The upper and lower ends of the monocrystal are again connected to a drawing mechanism which is able to draw the crystal out at very slow speed. In contrast to the Bridgeman method, the crystal is not in a crucible so that impurities stemming from the walls of the crucible will not occur. Between the inner walls of the oven and the crystal, there is a cylindrically-shaped container able to insulate the crystal from the heat of the oven. This container is pierced horizontally so that the heat is allowed to pass through a circular-shaped slit and can reach the corresponding parts of the monocrystal. The monocrystal is drawn slowly out of the oven, and thus it is constantly melted only in the region determined by the position of the slit. Through this process, the impurities migrate to the parts below the slit. As a result, the impurities are assembled in the very lowest part of the monocrystal. The apparatus is provided with an automatic temperature control which keeps the temperature constant with a tolerance of plus or minus 1° Centigrade. The control is carried out with the aid of photocells. This apparatus was not quite completed in early November 1954, but it was expected to be completed before the end of the year.

4. The Czrochalsky method applied in the Academy Institute for Medicine and Biology in Berlin-Buch combines features of the two methods mentioned above. The germanium is put into an open-topped crucible made of graphite. This crucible is first vacuum-heated for a period of three hours at a temperature of 2,000° Centigrade, in order to destroy impurities which it might possibly contain. The germanium metal is then vacuum-melted in the crucible at about 1,000° Centigrade. In its molten state the germanium forms a meniscus in the crucible. A point made of tungsten is introduced into the meniscus and drawn out of it mechanically at a speed of 0.2 to 2.0 millimeters per minute. In this way a pure germanium monocrystal is produced. Transistor work in the Institute has not progressed beyond this stage.

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